

## Page 1 **Overview**

Some mTBI patients experience delayed recovery. To treat these cases, it's important to determine first whether or not the patient is attempting to do too much too soon, thereby generating symptoms. It's advisable to remind the patient to cut back on activities *now*, rather than wait two weeks to see if the symptoms resolve. Treating issues up front can prevent complications from developing.

Some symptoms show up after the initial cluster of symptoms. For example, a patient may become more anxious and / or more depressed, and this becomes a problem for treatment. Or, under high-demand activities, symptoms may emerge that before were absent or seemingly resolved. For example, your patient injured in July may think she is fine, but when she returns to class at the end of the summer, she finds she can't concentrate.

If a patient is complying with the treatment plan and yet his or her symptoms have not cleared up in a reasonable amount of time (ten days to two weeks), it is time to adjust the treatment. Education will not be enough, nor will piecemeal, single-discipline therapy. A multidisciplinary team should be assembled to address the patient's delayed recovery.

The starting place for the team is based on these three issues:

1. Where is the patient with his or her symptoms? What is the type, intensity, and frequency of each symptom?
2. Is the patient complying with recommended treatments and activities?
3. What are the pre-morbidities and co-morbidities?

Symptoms are almost always multifactorial. It isn't necessary (or perhaps even possible) for a single team member to *treat* all of the symptoms, but each team member can *look for* and *be aware* of all the symptoms, to ensure nothing is missed.

The patient's array of persisting symptoms may eventually develop into a syndrome.

### **Post-Concussion Syndrome**

After one to three months of continuous symptoms, the ongoing post-concussion symptoms are identified as Post-Concussion Syndrome (PCS). Post-concussion syndrome is defined as:

"An aggregate of symptoms presenting after head injury including physical, cognitive, emotional, and sleep symptoms that persist beyond the usual recovery period after a concussion or past the acute post-injury period."

Institute of Medicine (IOM) *Sports-Related Concussions in Youth:*

*Improving the Science, Changing the Culture.*

<http://www.nap.edu/read/18377/chapter/1>

There are differences in diagnostic criteria between the ICD-10 and DSM-V systems. DSM-V does not identify Post-Concussion Syndrome. They changed the nomenclature to Neurocognitive Disorders.

#### **Diagnostic Criteria**

<b>ICD-10 for Post-Concussion Syndrome</b>	<b>DSM-V for Neurocognitive Disorders</b>

<p>Must have a history of traumatic brain injury and present at least three of the eight symptoms:</p> <ol style="list-style-type: none"> <li>1. Headache.</li> <li>2. Dizziness.</li> <li>3. Fatigue.</li> <li>4. Irritability.</li> <li>5. Insomnia.</li> <li>6. Concentration.</li> <li>7. Memory difficulty.</li> <li>8. Intolerance of stress, emotion, or alcohol.</li> </ol> <p>Medscape: Post-concussive Syndrome  <a href="http://emedicine.medscape.com/article/828904overview">http://emedicine.medscape.com/article/828904overview</a></p>	<p>Major and Mild Neurocognitive Disorders</p> <ol style="list-style-type: none"> <li>A. The criteria are met for major or mild neurocognitive disorder.</li> <li>B. There is evidence of a traumatic brain injury – that is, an impact to the head or other mechanisms of rapid movement or displacement of the brain within the skull, with one or more of the following: <ol style="list-style-type: none"> <li>1. Loss of consciousness.</li> <li>2. Post-traumatic amnesia.</li> <li>3. Disorientation and confusion.</li> <li>4. Neurological signs.</li> </ol> </li> <li>C. The neurocognitive disorder presents immediately after the occurrence of the traumatic brain injury, or immediately after recovery of consciousness, and persists past the acute post-injury period.</li> </ol> <p>The ICD-9 to ICD-10 Crosswalk made Easy: ICD-10 Code Lookup  <a href="http://www.icd10codesearch.com/">http://www.icd10codesearch.com/</a></p>
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## The mTBI Multidisciplinary Team

As described in the Fourth International Conference on Concussion in Sport Statement,

“Cases of concussion in sport where clinical recovery falls outside the expected window (i.e., 10 days) should be managed in a multidisciplinary manner by healthcare providers with experience in sports-related concussion.”

**4<sup>th</sup> International Conference on Concussion in Sport** <http://bjsm.bmj.com/content/47/5/250.full>

Ideally, the team should include professionals from a variety of disciplines, each of whom have special knowledge and training in mTBI, including (but not limited to):

- Physician (such as primary care, neurologist, sports medicine, physiatrist).
- Physical therapist, with special training in balance disorders.
- Occupational therapist, with special training in the treatment of visual processing disorders.
- Speech therapist, who will typically address cognitive rehabilitation.
- Neuropsychologist, who will assess brain function, as well as the contribution of behavioral, emotional, and motivational factors.
- Neuro-optometrist and / or neuro-ophthalmologist, an advanced specialist who will assess vision processing disorders.
- Educational specialist, who can serve as the liaison with the school.
- Other professionals who may also possess specialized training of value to a particular case requiring complex management, such as
  - Athletic trainer.
  - Audiologist.
  - Psychiatrist.
  - School nurse.

## Team Advantage in Delayed Recovery

Video

**LORI TERRYBERRY-SPOHR, PhD, ABPP, Madonna Rehabilitation Hospital, Director of Rehabilitation**

Although many individuals will recover from concussion quickly, there are some individuals, approximately 10 to 15%, who have delayed or prolonged recoveries, which are much more complex.

**KODY MOFFATT, MD, MS, Children's Hospital & Medical Center, Director of Pediatric Sports Medicine** Of that 10 percent, about eight percent will get better in two or three months, and the other remaining two percent can even have symptoms longer than three months.

**LORI TERRYBERRY-SPOHR**

Ideally, management of those prolonged recovery cases occurs in the context of a multidisciplinary team.

**RUSTY McKUNE, ATC, Nebraska Medicine, Sports Medicine Program Coordinator**

It's not just about cognition. It's not just about the physical attributes. It's not just about balance or visual issues. It's about a number of things working together and a number of professionals integrating what they do to help manage this injury that is going to help us be successful in the overall management and recovery of this patient.

**LORI TERRYBERRY-SPOHR**

The benefits of a multidisciplinary team include having many experts at the table to look at all the potential contributors and treatment options.

**KODY MOFFATT**

Different members of the team have different roles. In my role as the licensed health care professional, often acting as the conductor of the orchestra, it's important to take feedback from other members of the team and let them use their talents and skills. I think it's important to not directly tell other disciplines and dictate to them what they need to do.

**RUSTY McKUNE**

Each professional is going to look at the injury from a different perspective. And in doing that, they're going to be able to identify different aspects that need to be addressed throughout the recovery, and to provide a plan for moving forward that may not be available if we have just one person looking at this patient from one perspective.

**KODY MOFFATT**

Nebraska is a diverse state and you may not have a dream team available on hand, but it's important to recognize what tools and what professionals do you have available, who can you call on: the medical field, the rehab field, optometry, educational professionals, psychologist. And everybody has a role to play, and everybody needs to be communicating with each other and having the best interest of the teenager in mind.

Depending on the patient's needs, the team will provide specific medical and behavioral treatments for symptoms such as:

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Headache.           | <input type="checkbox"/> Sleep disruption.    | <input type="checkbox"/> Executive function issues. |
| <input type="checkbox"/> Vestibular issues.  | <input type="checkbox"/> Pain.                | <input type="checkbox"/> Mood instability.          |
| <input type="checkbox"/> Balance disruption. | <input type="checkbox"/> Noise sensitivity.   | <input type="checkbox"/> Personality change.        |
| <input type="checkbox"/> Visual problems.    | <input type="checkbox"/> Poor attention.      | <input type="checkbox"/> Anxiety.                   |
| <input type="checkbox"/> Fatigue.            | <input type="checkbox"/> Memory difficulties. | <input type="checkbox"/> Depression.                |

### **BIRSST Teams**

In Nebraska, the Nebraska Department of Education's Educational Service Units (ESUs) have BIRSST (Brain Injury Regional School Support Teams) who have training in managing TBI. The teams can provide Nebraska educators with materials, training, and consultative services to support students with brain injuries.

**BIRSST Resources** on the **NDE Concussion and Brain Injury Supports** page  
(including BIRSST Team Contacts)

<http://www.education.ne.gov/sped/birsst.html>

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## **Page 2 *Predictors & Contributors***

Recent research has found that certain factors in a patient's history may predict delayed recovery from mild traumatic brain injury. These are not absolute predictors because they have not yet been replicated with large samples, but they do provide interesting parameters to observe. Some are stronger predictors than others.

### **Predictors of Delayed Recovery**

- Female sex
- History of or presence of anxiety disorder
- Personal or Family History of Migraine Headaches
- History of Learning Disorder (LD) and / or Attention Deficit Hyperactive Disorder (ADHD)
- Personal or Family Anxiety / Mood Disorders
- History of Previous Concussions
- Loss of Consciousness > 1 minute
- Severity of the mTBI Symptom Presentation

When accounting for delayed recovery, you must look at the bigger picture. It's important to assess the level of exertion a patient can tolerate, and to check for all the contributing factors.

### **Contributing Factors**

When post-concussion symptoms persist, they often signal the presence of *undiagnosed* or *undertreated* contributing factors. These may be prior issues that have been made worse by the brain injury or may be new issues that commence as a result of the injury, thereby clouding the picture. A typical patient with delayed recovery may present with several contributing factors.

Brain injury is like a volume control knob. It's an "equal opportunity" disorder that affects everything. It may amplify pre-morbid conditions. For example, a patient with a learning disability may struggle more with learning.

Anxiety is an example of a factor that can be both a pre-existing condition and a result of the injury. If the patient tends toward anxiety, he or she will likely have more anxiety due to the injury. It's impossible to determine what percentage of the anxiety was present before and what came after.

With any of these heightened issues, it doesn't matter whether it's the chicken or the egg. You must treat it, or your patient won't get better.

### **Common Contributing Factors**

- Pre-existing Conditions, such as LD, ADHD, or Developmental Disabilities.
- Cognitive Issues.
- Emotional Difficulties.
- Cervicogenic Pain.
- Fatigue.
- Balance / Vestibular Disorders.
- Vision Disturbances.
- Post-Traumatic Headache.
- Disrupted Sleep / Wake Cycle.

If one contributing factor is present, it raises the possibility there is another, so it's advisable to look for all of them, or to refer the patient to the health care professional who can diagnose and treat each condition. Treatments for symptoms are generally the same no matter the cause, although in some cases determining the etiology can determine the best course of treatment (for example: the balance issues arising from central or peripheral issues). But, generally, a neurologist would treat a migraine like a migraine, no matter how it started, and anxiety is managed like anxiety, whether it arose before or after the injury.

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## **Page 3 *Tx: Physical SxS***

For patients with delayed recovery, treatment should be problem-specific.

### **Treatment for Physical Symptoms**

#### **Headache**

Primary care doctors are familiar with normal headache presentations, but post-concussive headaches can be multifactorial. Some physicians, usually neurologists, specialize in the medical management of headaches. In addition, the expertise of a multidisciplinary team can provide insights into the potential causes as well as a range of treatment options.

Post-traumatic headache can be a major culprit in delayed recovery, but it is not a diagnostic label. Knowing pre-existing headache causes and frequency will enable you to determine the origin of the patient's post-traumatic headache. A persistent headache may be unrelated to the mTBI. It could result from a neck injury, for example. Knowing the headache type (cervicogenic pain, occipital neuritis, migraine, tension headache, or vision-related) will help you treat it.

#### **Possible Headache Tx:**

- Manual therapies to address cervicogenic component.
- Vision rehabilitation (since the headache is unlikely to resolve until visual perception and oculomotor problems are treated).
- Medications.
- Biofeedback relaxation.
- Sleep stabilization.
- Self-management skills.

After three months, if headache pain is chronic without a basic physiological cause, other contributors should be considered, including psychological issues that can trigger or exacerbate headache presentation.

## Balance / Vestibular

There are multiple types of balance disorders. Some resolve quickly, but others require more time.

Balance can be multifactorial, involving:

- The vestibular system.
- Visual perception.
- Postural stability.

Specialists in balance disorders (such as physical therapists, some occupational therapists, and audiologists) may assess and treat complex interactions among sensory, motor, and central processes involved in posture and balance.

Postural stability is less likely to be an issue in young athletes, but should be considered when assessing the patient.

## Possible Balance / Vestibular Tx

Depending on the etiology (causation), some symptoms respond quickly to treatment. For example, when correctly diagnosed, Benign Paroxysmal Positional Vertigo often resolves in a few sessions of proper treatment. By contrast, central balance (i.e., arising from the brain) or dizziness problems may require weeks of specialized exercises and desensitization therapies.

## Vision Disturbance

As mentioned in Module 4, a primary care doctor can carry out visual assessments, including tests for pupil sensitivity and nystagmus. Again, the patient's history is very important.

Specialists (such as vision-certified occupational therapists, neuro-optometrists, and neuroophthalmologists) may address a variety of visual symptoms:

- |                           |   |  |
|---------------------------|---|--|
| • Double vision. □        | • Motion hypersensitivity. □                          | Post-Concussion Vision Syndrome, which may involve multiple difficulties:<br>○ Accommodative insufficiency. ○<br>Convergence insufficiency.<br>○ Saccadic dysfunction. |
| □ Blurry vision. □        | □ Decreased visual processing speed. Headaches due to |  |
| □ Visual perception. □    | visual strain.  |  |
| □ Sensitivity to light. □ |   |  |

Frequently, patients with delayed recovery from concussion present with previously undiagnosed visual disturbances. (There are various estimates as to how often.) Head injury sometimes brings such disturbances to light.

Ciuffreda KJ, Kapoor N, Rutner D et al. **Occurrence of oculomotor dysfunctions in acquired brain injury: a retrospective analysis.** Optometry 2007; 78: 155–161.

<http://www.drgalloway.com/wp-content/uploads/2013/06/Occurrence-of-oculomotor-dysfunctions-in-acquired-brain-injury-Ciuffreda.pdf>

Ellis et al (2017). Clinical predictors of vestibulo-ocular dysfunction in pediatric sports-related concussion. Journal of Neurosurgery, Pediatrics, 19, 38-45

## Possible Vision Disturbance Tx:



Treatments may involve special lenses and prisms, tinted lenses for contrast sensitivity, and / or binasal occlusion. Appropriate therapy may also include:

- Integration of vision with the balance system.
- Work on depth perception.
- Training in oculomotor coordination and visual tracking.

Knowledge in this area is rapidly evolving. Unusual or atypical disturbances sometimes occur and may warrant further evaluation.

### **Fatigue**

When you assess fatigue, it's important to determine the type of fatigue the patient is experiencing. Fatigue has two components: physical and mental. Activities that previously took little effort may require great amounts of energy after an mTBI. As a result, the patient may experience an overwhelming sense of tiredness that can be physical, mental, or both.

Fatigue may directly impact a young person's academic and physical performance by making sustained daily activities, attention, concentration, memory, communication, and emotional control more difficult.

### **Possible Fatigue Tx:**

- Improving sleep patterns.
- Decreasing pain.
- Conserving energy.
- Undergoing endurance therapy.
- Practicing pacing techniques.
- Taking medication.

Though it is clear that **high-risk** activity must be discontinued entirely during recovery, **low-level** exercise is being shown to have some value for mTBI patients, with a return to activities as soon as is tolerated the new recommendation.

See: Schneider KJ, Leddy JJ, Guskiewicz KM, Seifert T, McCrea M, Silverberg ND, Feddermann-Demont N, Iverson GL, Hayden A, Makdissi M. Rest and treatment/rehabilitation following sports-related concussion: A systematic review. Br J Sports Med. 2017 Jun;51(12):930-934

### **Sleep**

Issues with sleep are not the same as issues with fatigue. Sleep is important. It is healing time for the young person recovering from an mTBI. Your patient must not return to his or her previous sleeping pattern if it was insufficient. For example, a teenager's typical seven hours per night is not enough.

Visit the [National Sleep Foundation website](https://sleepfoundation.org/media-center/press-release/national-sleep-foundation-recommends-new-sleep-times) for recommended sleep times per age group.  
<https://sleepfoundation.org/media-center/press-release/national-sleep-foundation-recommends-new-sleep-times>

### **Possible Sleep Issues Tx:**

There are two major considerations in treating sleep problems.

1. If the sleep issues are chronic, the issues should be addressed by sleep specialists, such as ENTs, otolaryngologists, and / or neurologists.
2. It's important to make sure the patient is getting enough sleep acutely. This is true for all youth, but especially true if a child is injured. A concussion patient may need to sleep more, immediately

after injury as well as in cases of Post-Concussion Syndrome. Naps, even in school, may be important to recovery. Parents should let the young person sleep, and even encourage sleep if necessary, intervening to help reduce bad bedtime habits:

- Make bedtime a time to go to bed and sleep.. Ensure the youth goes to bed at a consistent time every night.
- Practice good sleep hygiene: no computers, phones, screens, or LEDs close to the bed.
- Make sure the patient doesn't do anything in the bed except sleep: for example, no reading or watching television.

### **A Special Note about Pain**

Pain is a huge, complicating factor. You may confound pain with head injury or head injury with pain, treating one but missing the other. Pain is a distractor. For example, pain from a knee injury might distract the patient's attention and undermine the patient's performance on tests. A major concern with multiple **concussions and PCS is the impact** of headaches and chronic pain. Regardless of whether pain is due to the head trauma or due to a different source, you will need to understand the pain's relationship to the head injury. You need to diagnose the *cause* of the pain and treat it.

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## **Page 4 Tx: Cognitive SxS**

As a member of the multidisciplinary treatment team, a specialist (such as a neuropsychologist) provides cognitive and behavioral assessment, as well as psychological support, and evaluates the effect of cognitive problems on behavioral function.

### **Treatment for Cognitive Symptoms**

#### **Basic Cognition**

The neuropsychologist will first evaluate the young person's history and complaints. Recovery of cognition is often tested and monitored through neuropsychological testing.

#### **Cognitive & Behavioral**

When treating long-term cognitive and behavioral issues, a neuropsychologist:

- Understands the young person wasn't referred for psychosocial reasons.
- Utilizes a normal adjustment model.
- Treats the student as a previously well-functioning student in the midst of a change.
- Works to remove barriers so the young person is able to participate fully in PT, OT, and ST.

#### **Cognitive-Communicative**

A specialist (such as a speech-language pathologist) develops and trains *individualized* compensatory cognitive-communication strategies for the young person to:

- Support attention.
- Improve memory.
- Aid in problem-solving.
- Enhance executive functioning.

If the patient's school has speech and language professionals on staff, they can assist with strategies. In some schools, in order for the school's speech/language therapist to address the issues, the student's condition must be affecting schoolwork. Schools will decide if they will provide treatment at school. However, schools have differences in how they identify and code cognitive issues, so you'll need to work



with them. Check to ensure the necessary services are not only available, but accessible to the patient. School-based and hospital speech and language services should be coordinated.

### **Disabilities**

Youth with pre-morbid learning and developmental disabilities have all the same problems they had before, but now they have concussion issues on top of the disorders and disabilities.

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## **Page 5 Tx: Emotional SxS**

Anxiety (whether due to pre-morbidity, family history, or injury) is a typical emotional symptom mTBI patients experience. Those suffering from anxiety disorder are prone to over-attend and over-attribute their symptoms. Anxiety magnifies their symptoms. Patients with a predilection for stress may be hypervigilant, researching their conditions online and heightening their anxiety with self-diagnosis that can become self-fulfilling prophesies. Some become nervous about testing and fail due to nervousness rather than actual symptoms.

Emotional adjustment will involve helping the young person reintegrate into the school environment. Reintegration requires finding appropriate accommodations for all areas of life at school.

### **Treatment for Emotional Symptoms**

#### **Reintegration**

Missing even two weeks of school has significant consequences.

Reintegration will take place in the athletic realm when the young person returns to the team. As in the classroom, social dynamics will play a part in the sports setting. The player who sits out with an mTBI is sometimes bullied or mocked as a “wimp”. To ease adjustment, it can be helpful for the young person to spend time just being with the team before actually returning to play. Be aware of over-stimulation.

If ancillary therapy is available in the school, the team can incorporate it into the adjustment plan, if appropriate. Reintegration into the school environment is essential to successful recovery. An educational or work re-entry specialist can aid in this reintegration.

#### **Issues**

Common adjustment issues include:

- Maladaptive pain coping responses (e.g. activity avoidance due to fear of re-injury).
- Situational discouragement or depression.
- Return to Activity anxieties and fears.
- Normal human emotional reactions that accompany temporary disability, which must be handled appropriately to prevent the emotional response(s) from becoming permanent.
- Fear of driving.

#### **Injury's Impact**

Sometimes patients with concussion can develop diagnosable mental health conditions that require a comprehensive treatment approach, such as counseling with medication. These can be full-blown problems or lower-level issues. The point is, these emotional problems are real and need to be

addressed. For example, being depressed about not being able to play is not the equivalent of clinical depression, but it still can affect recovery.

### **Context**

It's essential to consider these problems in the context of everything else happening in the patient's life. All are interwoven. The treatment team should look for symptoms of emotional problems that can exacerbate concussion symptoms. Some issues are higher level and must be treated first. Ignoring these symptoms may result in lack of treatment success.

### **Responses**

It may help to describe to your patient what you are going to treat. Patients may respond more readily if they are told they are being treated for anxiety due to concussion complications, rather than for high level mood disorder. The concussion may be causing or compounding emotional issues. In either case, it's not enough to address these symptoms medically. As you would when treating full-blown mood and anxiety disorders, you should offer a combination of behavioral and medical treatments and referral to specialists, such as psychiatrists.

### **Conclusion**

With the help of a treatment team including diverse medical professionals, an ever-expanding array of diagnostic and treatment resources, and a recovery team including the patient and his or her support system, the licensed health care professional can guide the young person to the best possible outcomes following mild traumatic brain injury. To remain well-equipped for treating young concussion sufferers, you are encouraged to return to this site for updated resources and information regarding best practices.